US009250691B2

(12) **United States Patent**
Vandeputte et al.

(10) **Patent No.: US 9,250,691 B2**
(45) **Date of Patent: Feb. 2, 2016**

(54) **METHOD, APPARATUS AND SYSTEM FOR POWER MANAGEMENT THROUGH BACKLIGHT AND OTHER PERIPHERAL CONTROLS**

(75) Inventors: **Casey Vandeputte**, Waterloo (CA); **Teodoro Salluzzi**, Slough (GB)

(73) Assignee: **BlackBerry Limited**, Waterloo, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 125 days.

(21) Appl. No.: **12/964,335**

(22) Filed: **Dec. 9, 2010**

(65) **Prior Publication Data**

US 2012/0151236 A1 Jun. 14, 2012

(51) **Int. Cl.**

H04M 1/00	(2006.01)
G06F 1/32	(2006.01)
H04B 1/16	(2006.01)
G06F 1/00	(2006.01)
G09G 3/36	(2006.01)

(52) **U.S. Cl.**

CPC ***G06F 1/3265*** (2013.01); ***G06F 1/3209*** (2013.01); ***G06F 1/3287*** (2013.01); *Y02B 60/1242* (2013.01); *Y02B 60/1282* (2013.01)

(58) **Field of Classification Search**

CPC H04W 52/0245; H04M 1/72519
USPC 455/566, 343.5; 713/324; 345/102
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0036637	A1 *	3/2002	Ogawa	345/212
2002/0093923	A1 *	7/2002	Bouet	370/328
2003/0159075	A1	8/2003	Miyazaki	
2004/0043800	A1 *	3/2004	Hosoi	455/575.1
2008/0065918	A1	3/2008	Wong	
2011/0260958	A1 *	10/2011	Shabel et al.	345/102

FOREIGN PATENT DOCUMENTS

JP 2001036637 A 2/2001

OTHER PUBLICATIONS

EESR; EP App. No. 10194419.7; dated Jun. 8, 2011.

Sharp Electronics: "YO-500 YO-530 Operation Manual", Jan. 15, 2003, pp. 1-146, XP002635507, retrieved from http://www.sharpusa.com/downloads/archives/product_manuals/org_man_YO500-530.pdf, retrieved on May 4, 2011.

http://www.datamystic.com/filewatcher.html; retrieved Dec. 9, 2010.

Examination Report mailed Jul. 24, 2013, in corresponding European patent application No. 10194419.7.

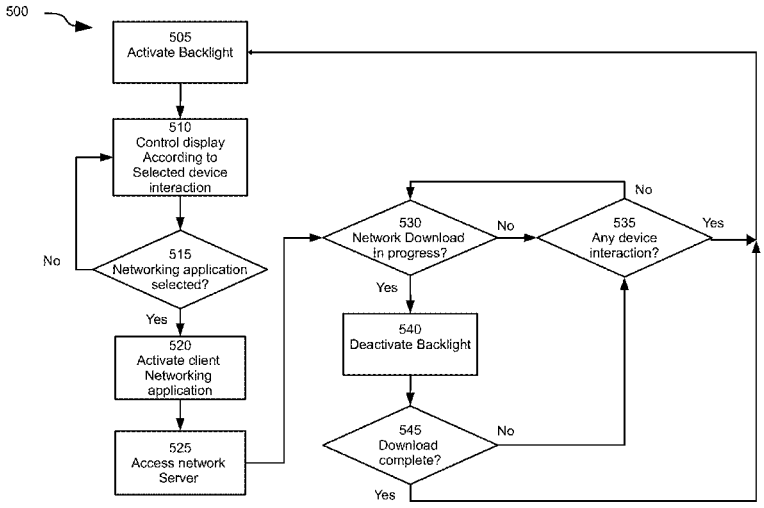
* cited by examiner

Primary Examiner — Muthuswamy Manoharan
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

A method, apparatus and system for power management in a mobile computing device is provided. In one aspect, the mobile computing device comprises a display with a backlight that is power by a power supply under the control of a processor. The mobile computing device is also configured to execute a web browser or other application that access a network resource. Activation of the backlight is controlled in coordination with the network resource in order to manage drain of power from the power supply.

13 Claims, 14 Drawing Sheets



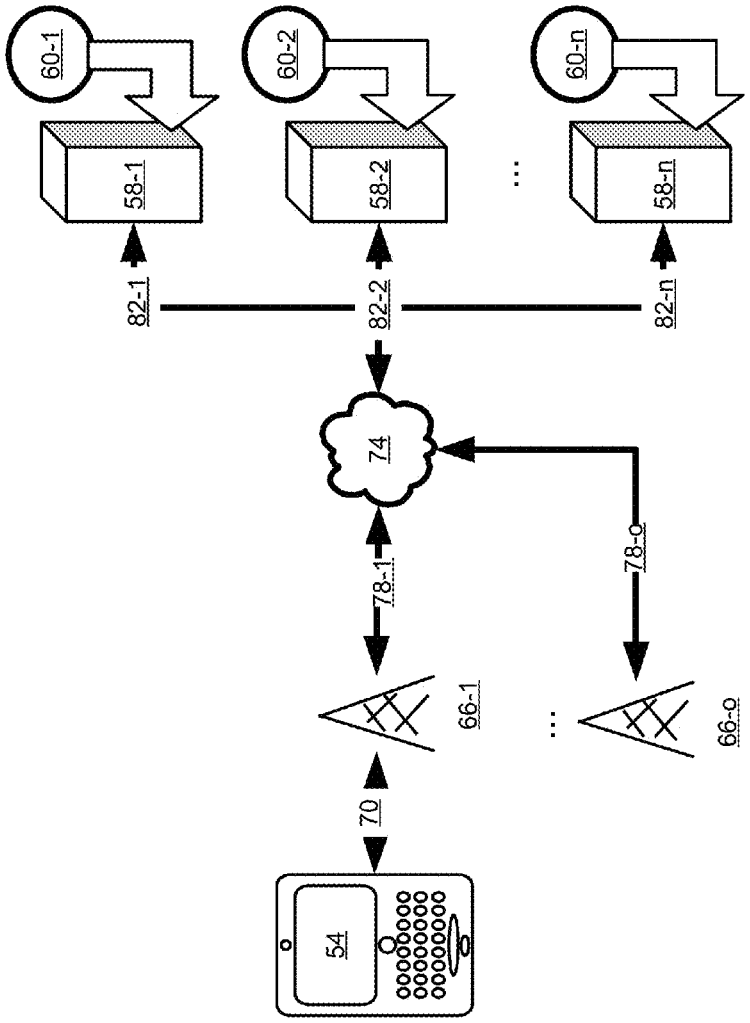


Fig. 1

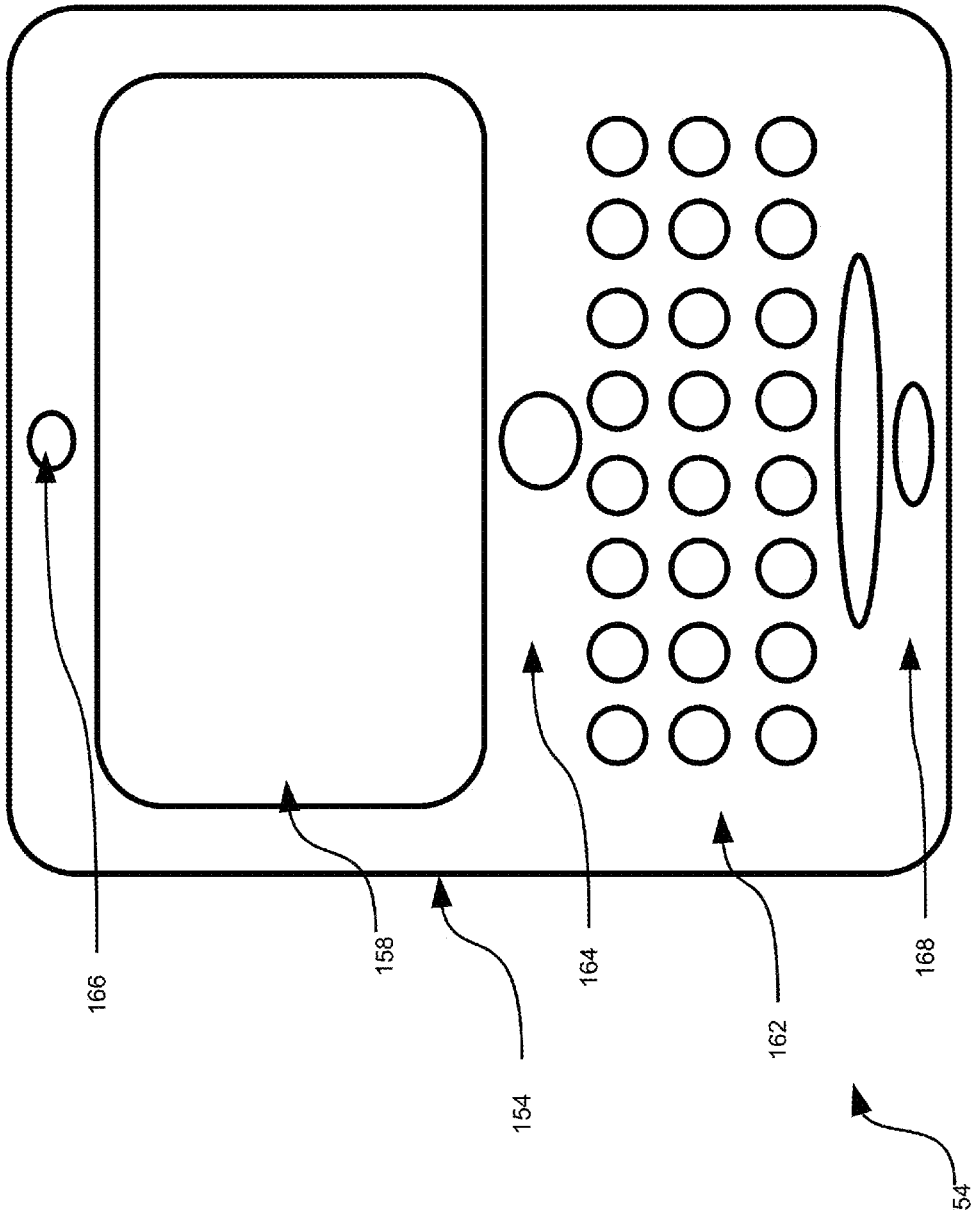


Fig. 2

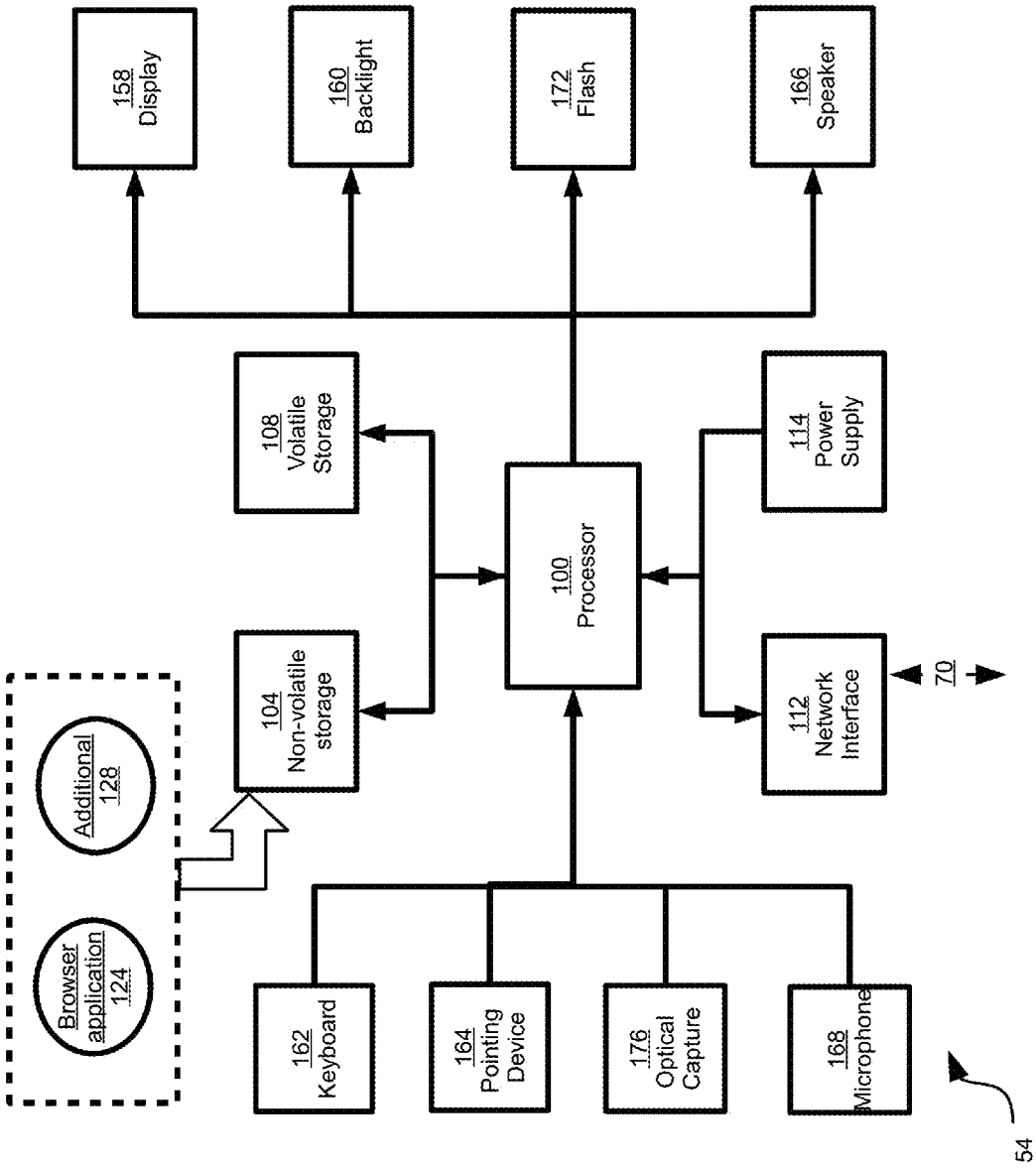

158 Display
160 Backlight
172 Flash
166 Speaker
108 Volatile Storage
114 Power Supply
100 Processor
104 Non-volatile storage
112 Network Interface
70
Additional 128
Browser application 124
162 Keyboard
164 Pointing Device
176 Optical Capture
168 Microphone
54

Fig. 3

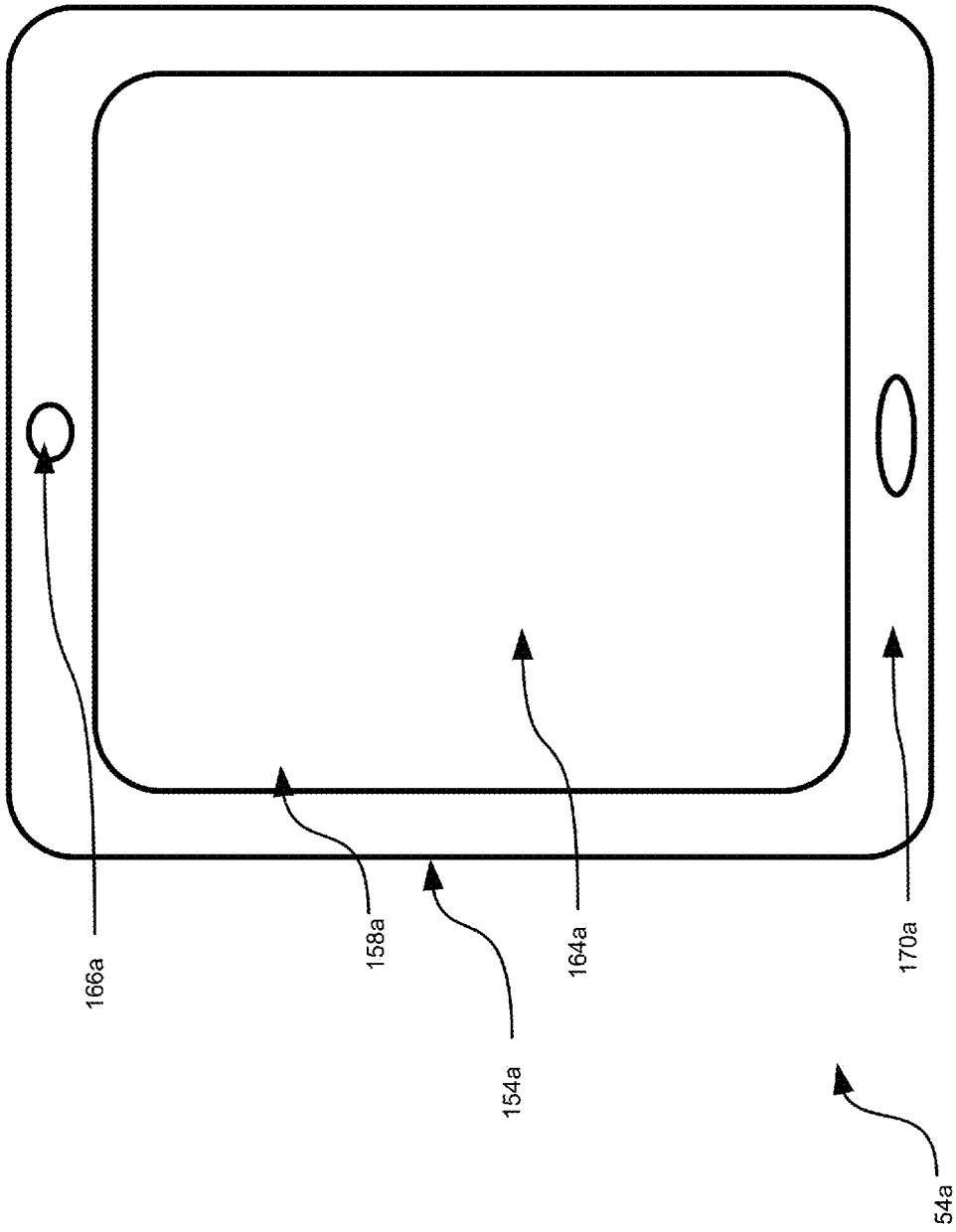


Fig. 4

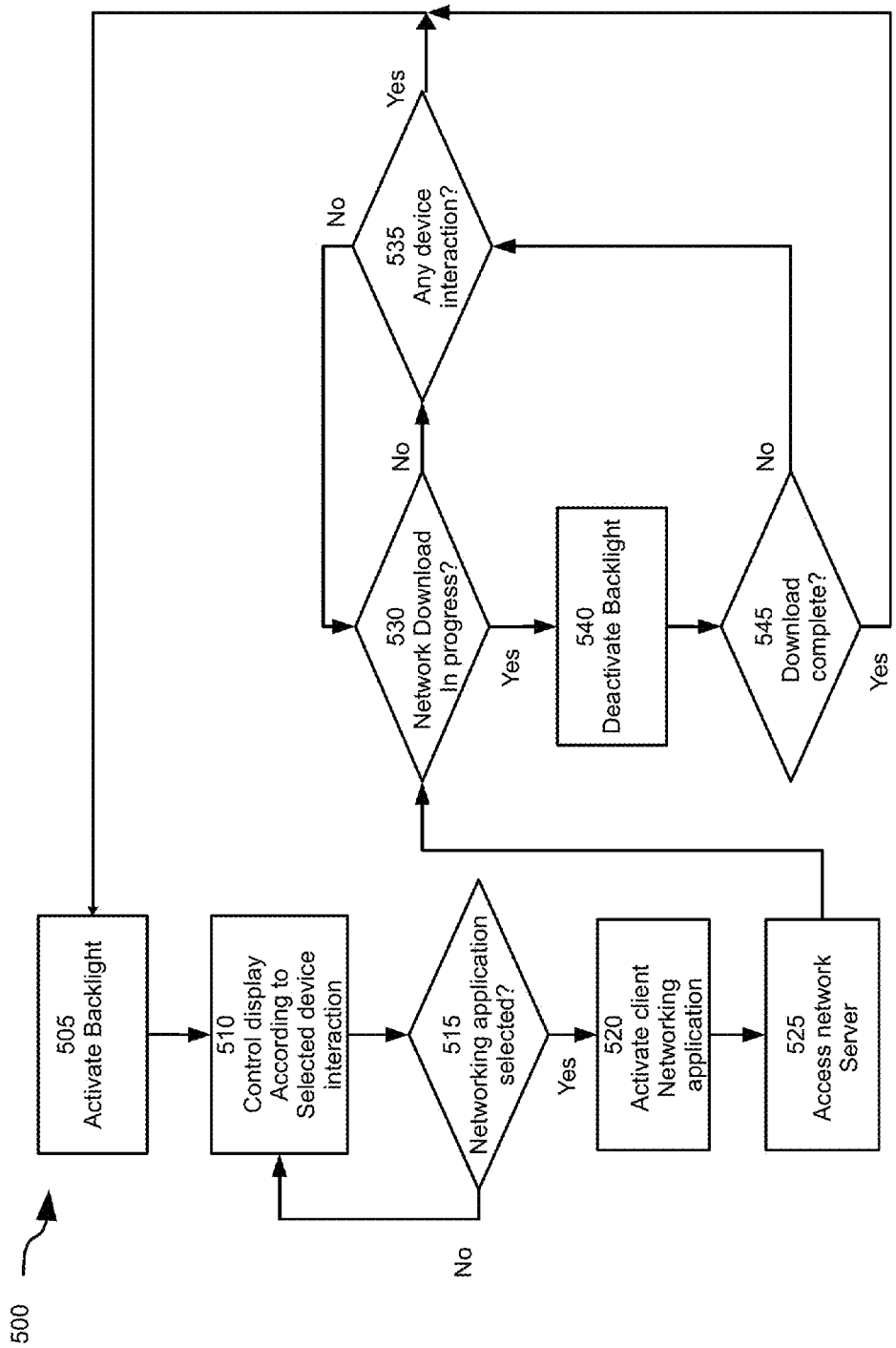

500
505
Activate Backlight
510
Control display According to Selected device interaction
515
Networking application selected?
Yes
No
520
Activate client Networking application
525
Access network Server
530
Network Download In progress?
Yes
No
540
Deactivate Backlight
545
Download complete?
Yes
No
535
Any device interaction?
Yes
No

Fig. 5

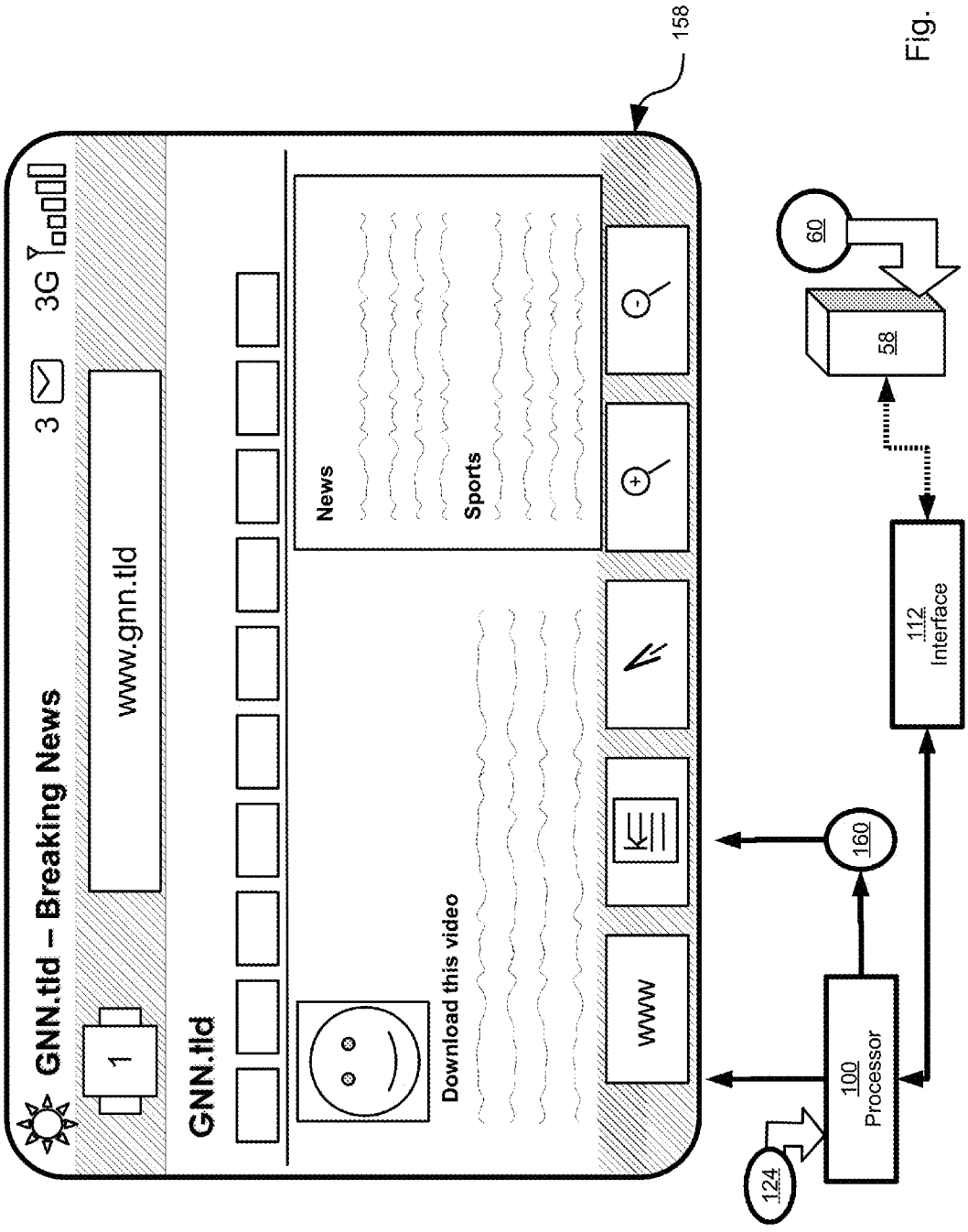

158
GNN.tld – Breaking News
3G
www.gnn.tld
GNN.tld
News
Sports
Download this video
WWW
60
58
112
Interface
160
100
Processor
124

Fig. 6

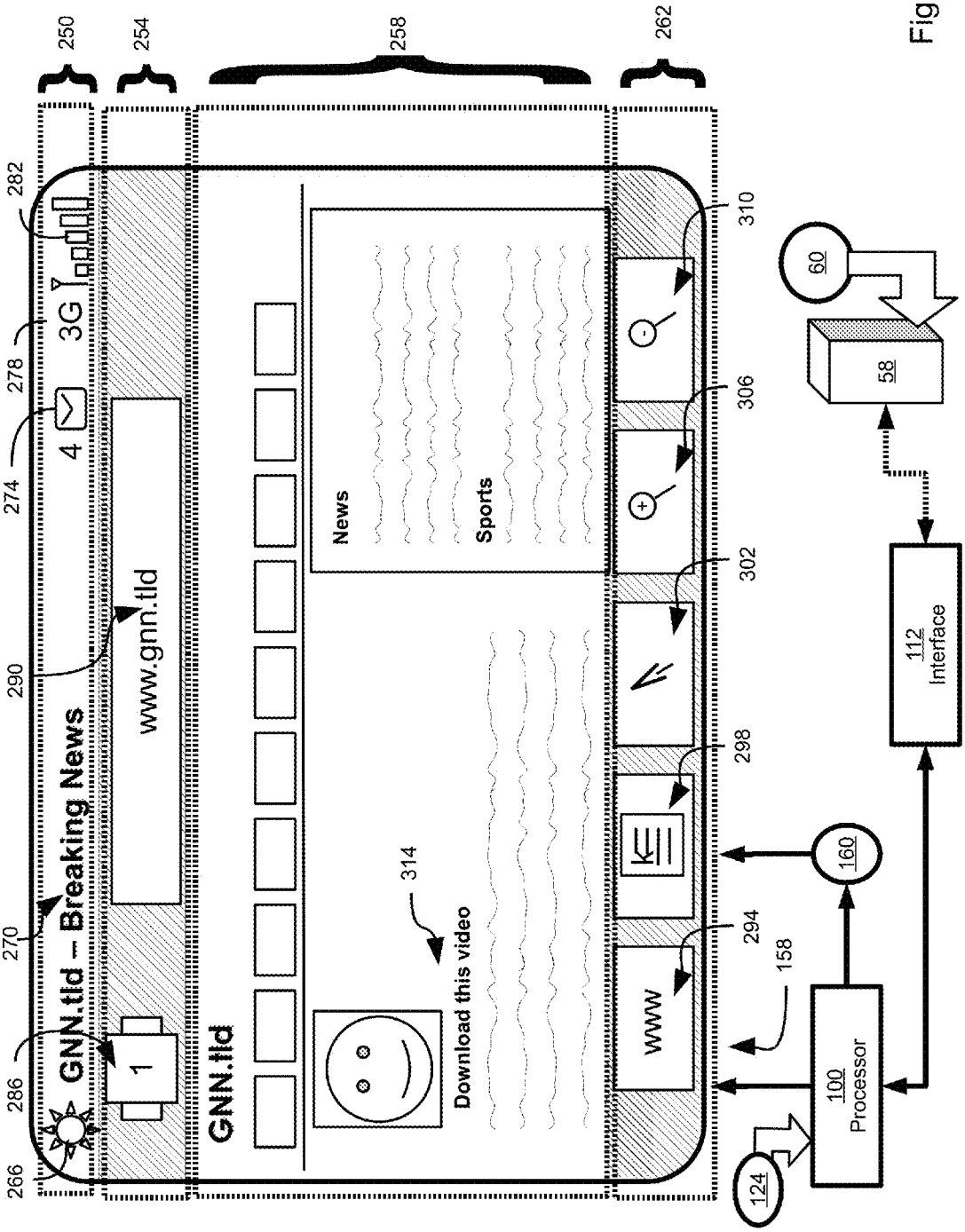

250
254
258
262
282
278
274
290
270
286
266
3G
4
1
GNN.tld – Breaking News
www.gnn.tld
GNN.tld
News
Sports
Download this video
314
310
306
302
298
294
158
WWW
160
60
58
112
Interface
100
Processor
124

Fig. 7

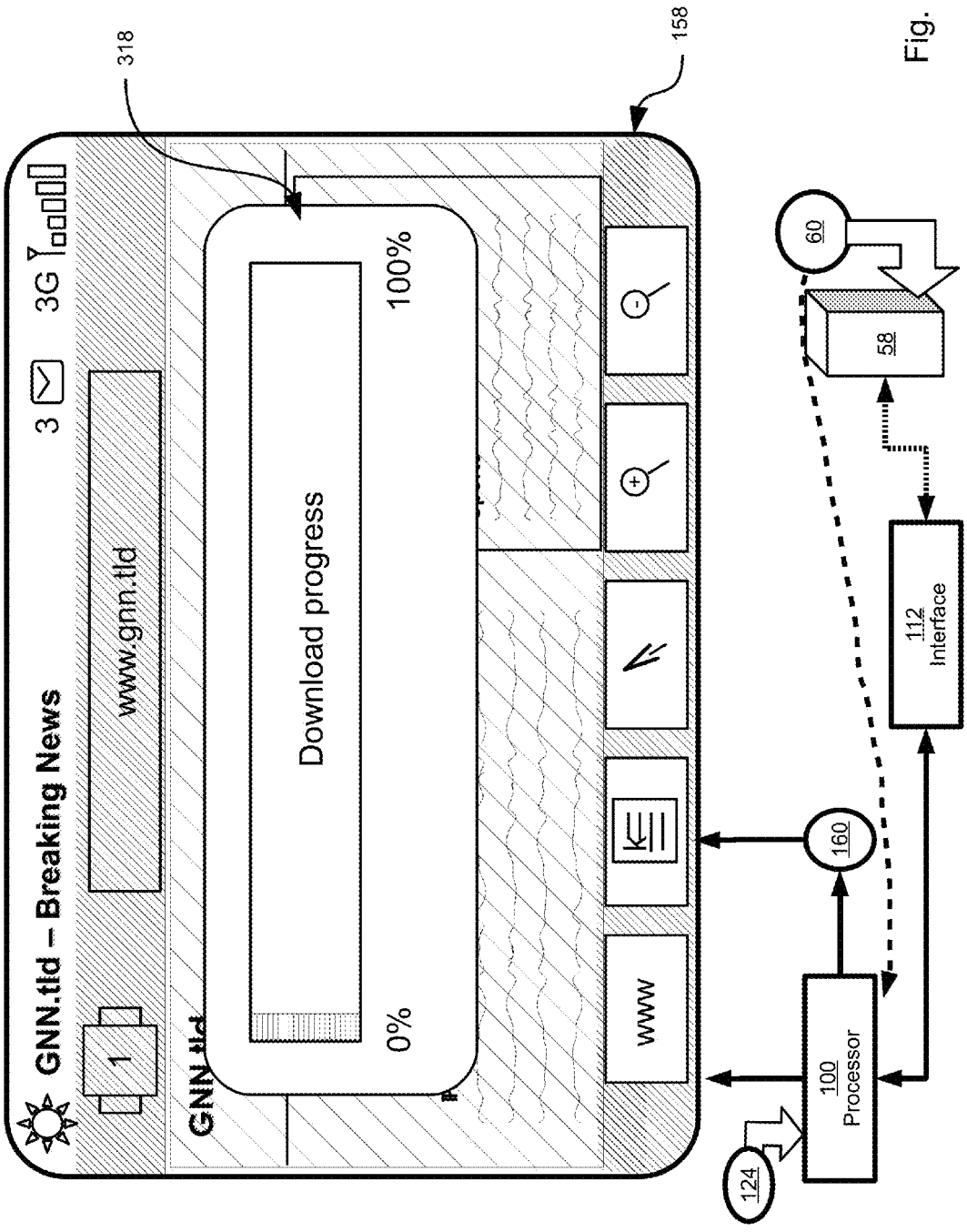

318
158
GNN.tld – Breaking News
3G
www.gnn.tld
Download progress
100%
0%
GNN.tld
www
60
58
112
Interface
160
100
Processor
124

Fig. 8

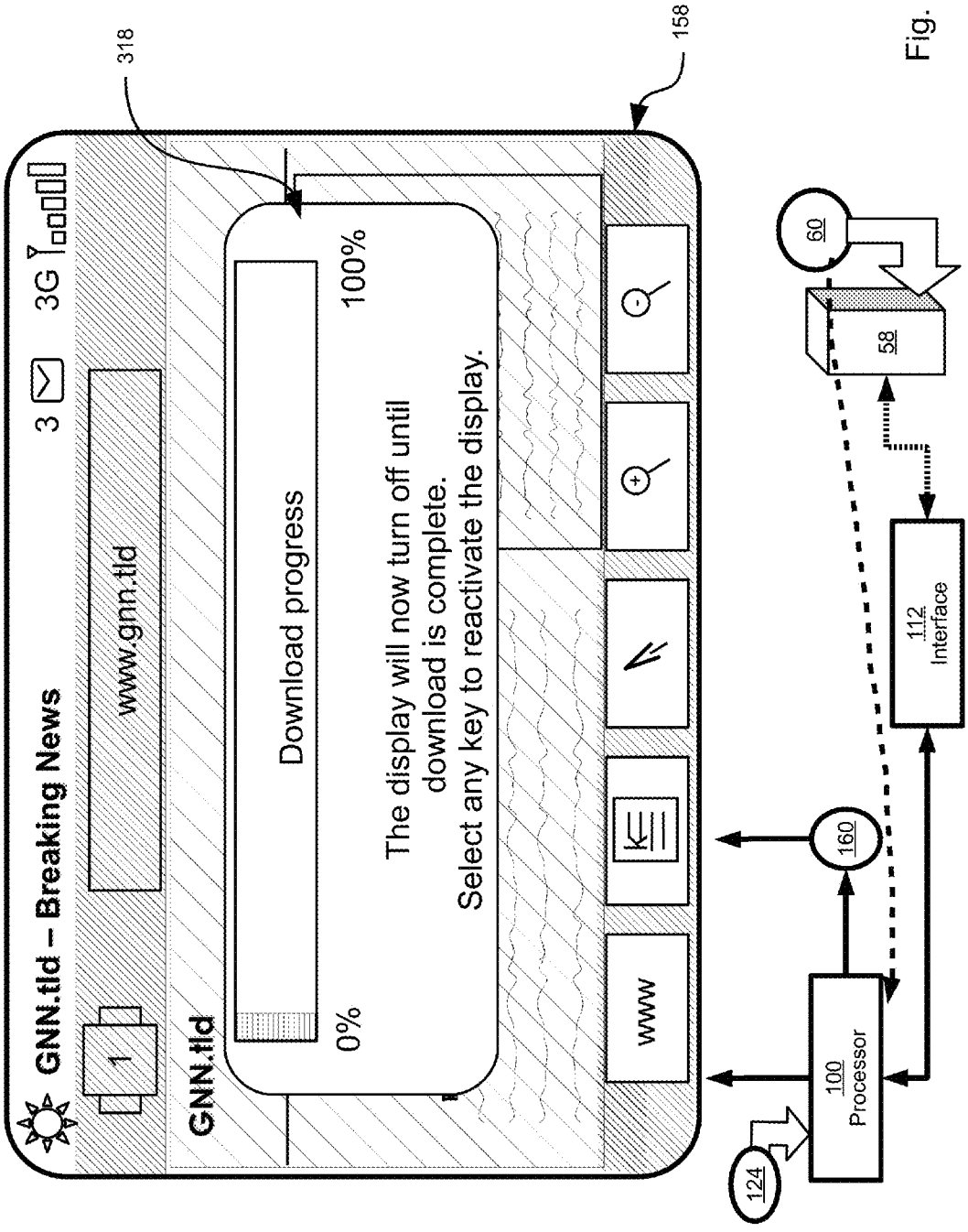

318
158
GNN.tld – Breaking News
3
3G
1
www.gnn.tld
GNN.tld
Download progress
0%
100%
The display will now turn off until download is complete.
Select any key to reactivate the display.
www
60
58
112 Interface
160
100 Processor
124

Fig. 9

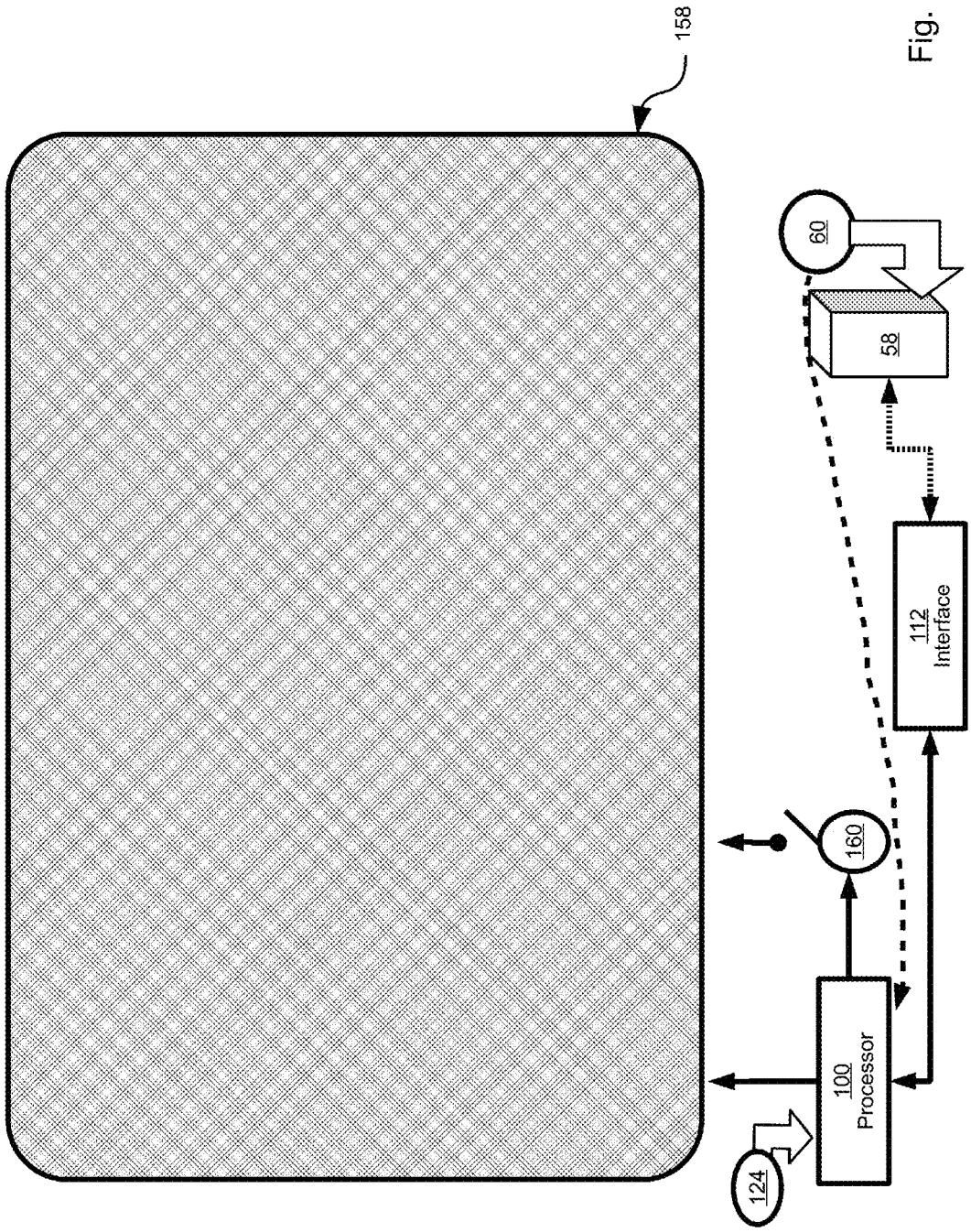


Fig. 10

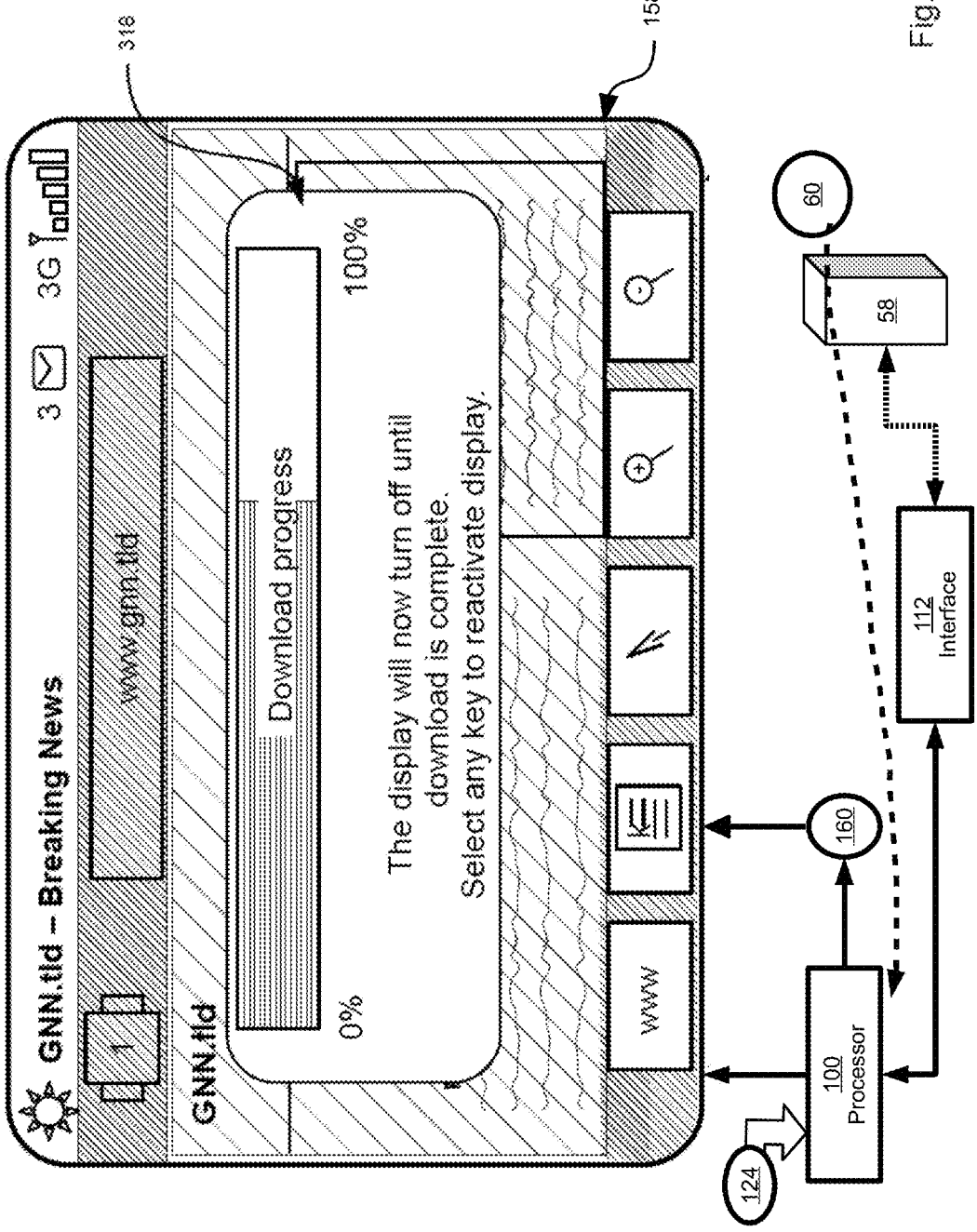

316
158
GNN.tld – Breaking News
3G
www.gnn.tld
GNN.tld
Download progress
0%
100%
The display will now turn off until download is complete.
Select any key to reactivate display.
WWW
60
58
112
Interface
160
100
Processor
124

Fig. 11

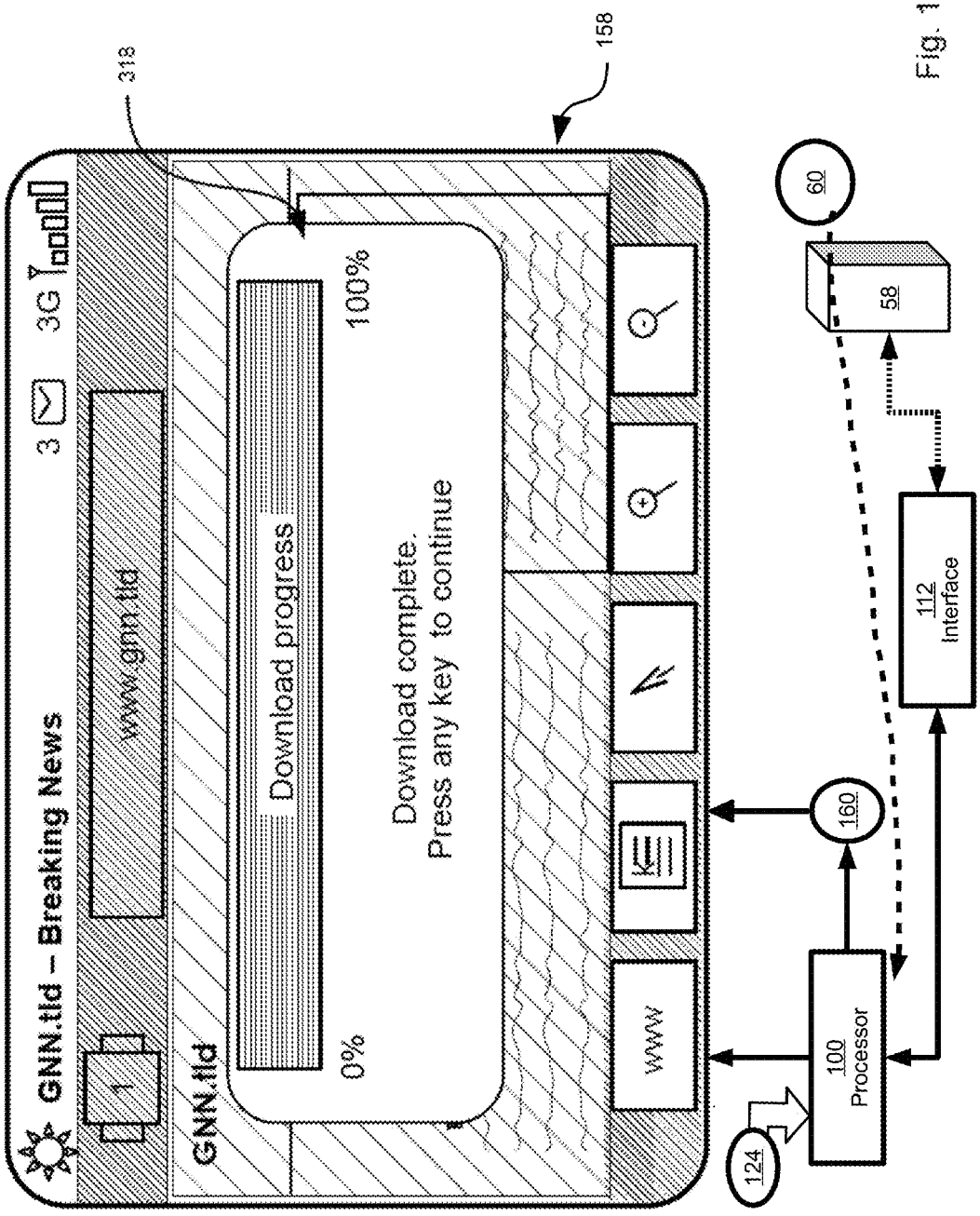

318
158
GNN.tld – Breaking News
3G
www.gnn.tld
GNN.tld
Download progress
100%
0%
Download complete.
Press any key to continue
WWW
60
58
112
Interface
160
100
Processor
124

Fig. 12

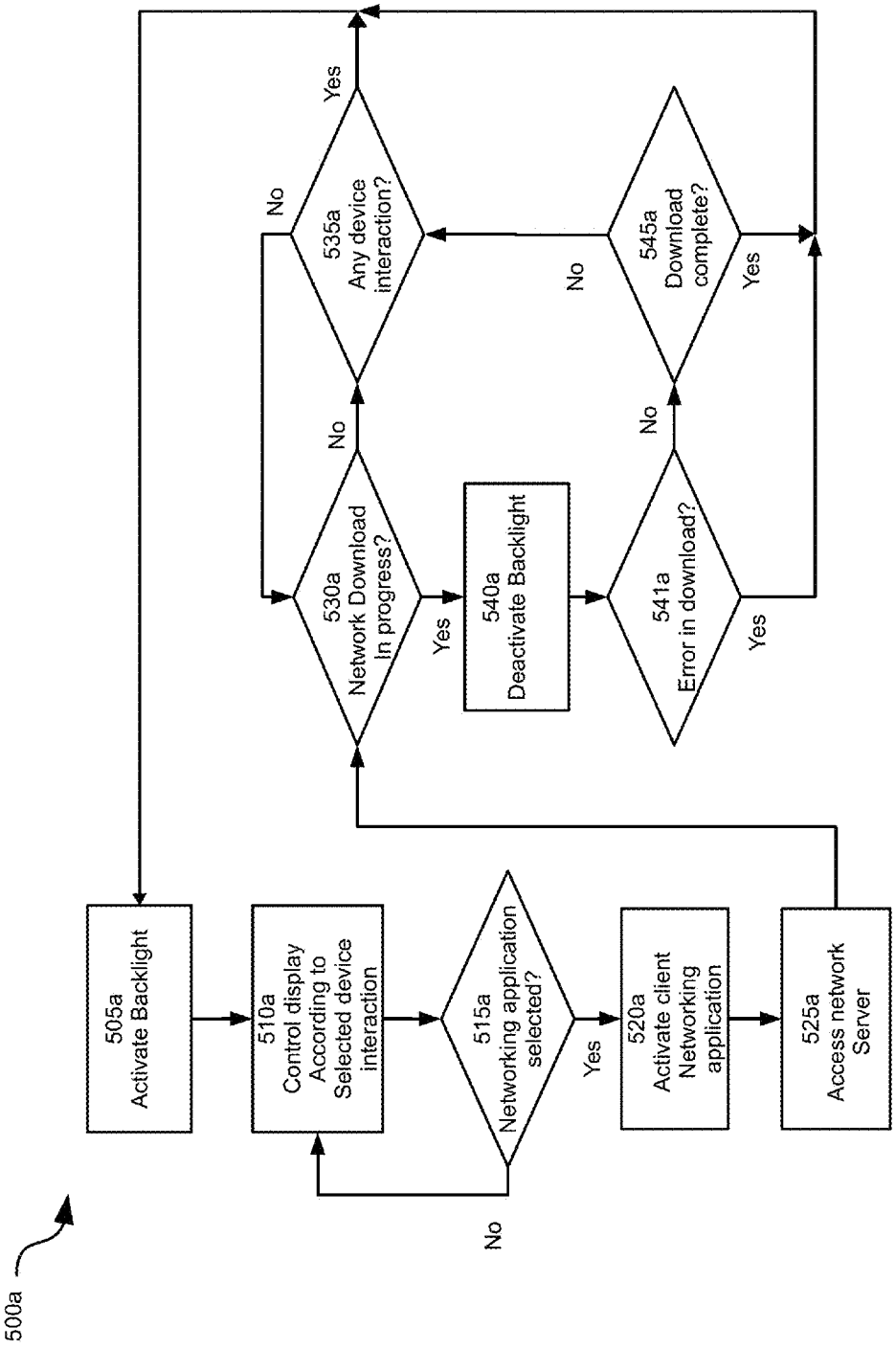

500a
505a Activate Backlight
510a Control display According to Selected device interaction
515a Networking application selected?
No
Yes
520a Activate client Networking application
525a Access network Server
530a Network Download In progress?
No
Yes
540a Deactivate Backlight
541a Error in download?
No
Yes
535a Any device interaction?
No
Yes
545a Download complete?
No
Yes

Fig. 13

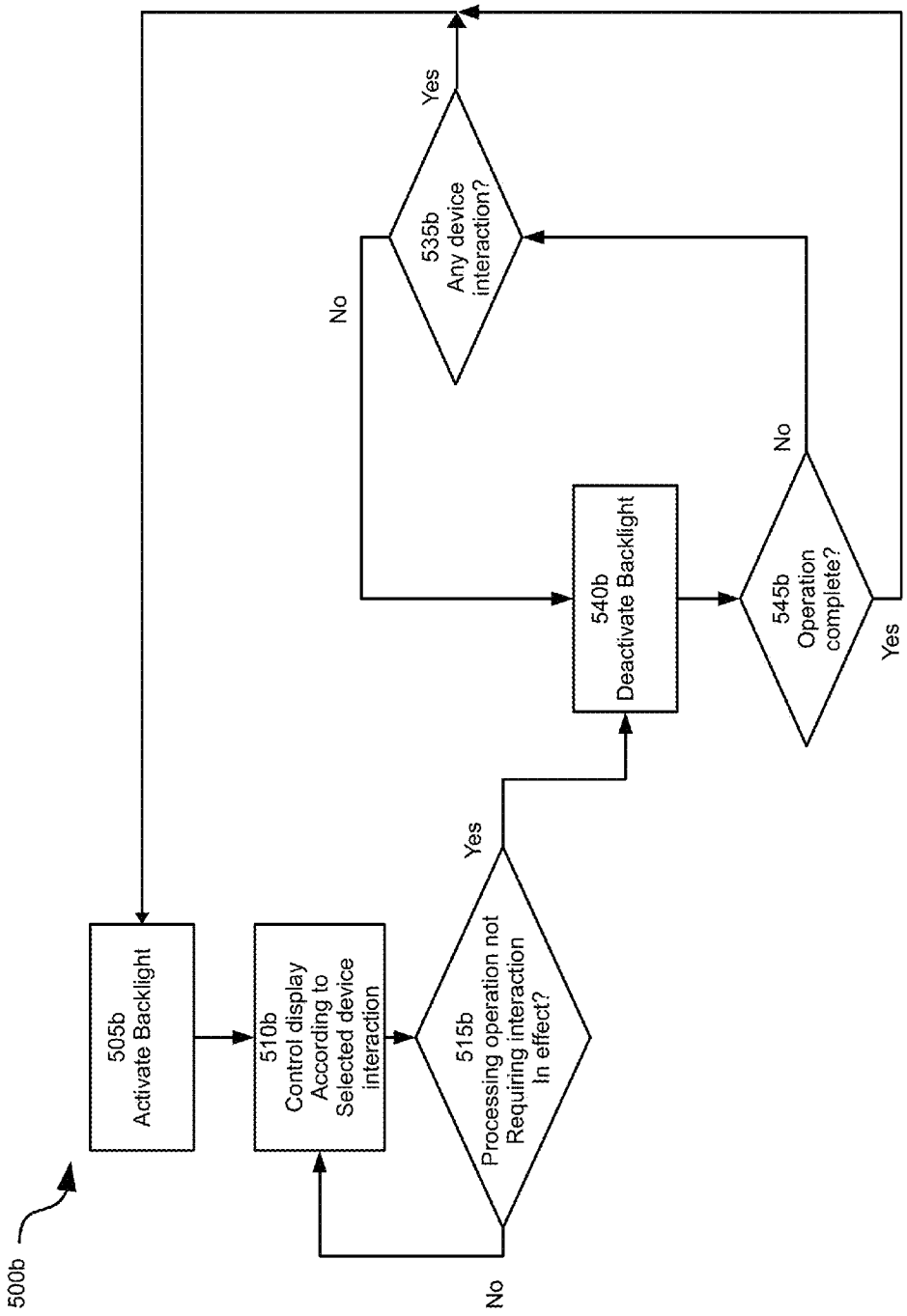

500b
505b
Activate Backlight
510b
Control display
According to
Selected device
interaction
515b
Processing operation not
Requiring interaction
In effect?
Yes
No
540b
Deactivate Backlight
545b
Operation
complete?
No
Yes
535b
Any device
interaction?
Yes
No

Fig. 14

METHOD, APPARATUS AND SYSTEM FOR POWER MANAGEMENT THROUGH BACKLIGHT AND OTHER PERIPHERAL CONTROLS

FIELD

The present specification relates generally to computing devices and more particular relates to a method, apparatus and system for power management through backlight and other peripheral controls.

BACKGROUND

The evolution of computers is currently quite active in the mobile device environment. However, as the processing and wireless communications demands on such device increases, so too do the demands on management of battery life.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic representation of a system for power management in a mobile computing device.

FIG. **2** is a representation of a front view of the mobile computing device of the system of FIG. **1**.

FIG. **3** is a block diagram of the device shown in FIG. **1**.

FIG. **4** is a representation of a variation of the mobile computing device of FIG. **1**.

FIG. **5** is a flow chart representing a method for power management in a mobile computing device.

FIG. **6** shows certain elements of the device of FIG. **3** when executing the web browser application.

FIG. **7** shows the same representation of the device as FIG. **6**, except that further reference characters are provided to explain certain elements shown on the display of the device as generated by the device's processor.

FIG. **8** shows another representation of the device of FIG. **6**.

FIG. **9** shows another representation of the device of FIG. **6**.

FIG. **10** shows another representation of the device of FIG. **6** where the display has been deactivated.

FIG. **11** shows another representation of the device of FIG. **6** where the display has been reactivated when the file transfer is partially complete.

FIG. **12** shows another representation of the device of FIG. **6** where the display has been reactivated when the download is complete.

FIG. **13** shows a variation on the flow chart of FIG. **5**.

FIG. **14** shows a variation on the flow chart of FIG. **5**.

DETAILED DESCRIPTION

A method, apparatus and system for power management in a mobile computing device is provided. In one aspect, the mobile computing device comprises a display with a backlight that is powered by a power supply under the control of a processor. The mobile computing device is also configured to execute a web browser or other application that accesses a network resource. Activation of the backlight is controlled in coordination with the network resource in order to manage drain of power from the power supply.

Another aspect of this specification provides, more generally, a method for power management in a mobile computing device comprising: activating a display in the mobile computing device such that a first amount of power is drawn from a power supply of the mobile computing device; deactivating the display such that a second amount of power is drawn from the power supply, the second amount being less than the first amount, when a processing operation is occurring which does not require generation of output or reception of input and, activating an output apparatus after at least a portion of the processing operation is complete.

The processing operation may comprise at least one of a file transfer, an application installation, playing an audio file, implementing a device boot-up sequence, and installation of a device theme.

The processing operation may be a data transfer occurring between the mobile computing device and a remote computing apparatus connected to the mobile computing device. The method may further comprise reactivating the display during the data transfer upon detecting a device interaction other than a completion of the at least a portion of the data transfer. The method may further comprise deactivating the display if the device interaction ceases and the at least a portion of the data transfer has not completed. The remote computing apparatus may be a server connected to the computing device via a network and the data transfer may be a download from the server. The remote computing apparatus may be another computing device connected via a peer-to-peer connection to the computing device. The remote computing apparatus may be storage device locally connectable to the computing device. The at least a portion of the processing operation may be an the receipt of an entirety of the data transfer.

The activating of the output apparatus may comprise reactivating the display.

The deactivating may comprise dimming the display such that the second amount is reduced but still greater than zero.

The deactivating may comprise turning off the display such that the second amount is zero.

The activating of the output apparatus may comprise activating at least one of an indicator light, generation of an audio signal or generation of haptic output from the device.

The device interaction may comprise any one or more of: receipt of input via an input apparatus connected to the mobile computing device; when an automatic refresh of web page occurs; when any type of data other than the data transfer is received by the device; an alarm; a calendar notification; when a secure web page is generating a warning of automatic connection termination due to inactivity.

The reactivating of the display may be configured to occur if the data transfer fails before the at least a portion of the data transfer is complete.

The display may comprise a backlight and the activating may comprise activating the backlight and the deactivating may comprise deactivating the backlight.

According to another aspect of this specification, a mobile computing device is provided in accordance with any of the foregoing methods.

According to another aspect of this specification, a remote computing apparatus is provided in accordance with any of the foregoing methods.

According to another aspect of this specification, another computing device is provided in accordance with any of the foregoing methods.

According to another aspect of this specification, a computer readable medium storing a plurality of programming instructions that are executable on a processor of a mobile computing device is provided in accordance with any of the foregoing methods.

Referring now to FIG. **1**, a system for power management in a mobile computing device is indicated generally at **50**. In a present embodiment system **50** comprises at least one computing device in the form of a mobile computing device **54**

and at least one server **58-1**, **58-2** . . . **58-*n***. (Generically, server **58**, and collectively, servers **58**. This nomenclature is used elsewhere herein).

A wireless link **70** connects mobile computing device **54** with one of a plurality of wireless base stations **66**. In FIG. **1**, mobile computing device **54** is shown as connecting to a first base station **66-1** via wireless link **70**, but mobile computing device **54** can also connect to other base stations **66** in system **50**. Backhaul links **78** connect each base station **66** to a network **74**. Additional backhaul links **82** connect network **74** to each server **58**.

Mobile computing device **54** can be any type of electronic device that can be used in a self-contained manner and to interact with content available on network **74**. Interaction includes displaying of information on mobile computing device **54** as well as to receive input at mobile computing device **54** that can in turn be sent back over network **74**. Mobile computing device **54** will be explained in greater detail below.

It should now be understood that the nature of network **74** and links **70**, **78** and **82** associated therewith is not particularly limited and are, in general, based on any combination of architectures that will support interactions between mobile computing device **54** and servers **58**. In a present embodiment network **74** includes the Internet as well as appropriate gateways and backhauls to links **78** and **82**. For example, backhaul links **78** and backhaul links **82** can be based on a T**1**, T**3**, O**3** or any other suitable wired or wireless connections. Accordingly, the links **78** and **82** between network **74** and the interconnected components are complementary to functional requirements of those components.

Link **70** may be based on, by way of non-limiting examples, a core mobile network infrastructure, such as, by way of non-limiting examples, one or more of Global System for Mobile communications ("GSM"); Code Division Multiple Access ("CDMA"); CDMA 2000; 3G; or Evolution-Data Optimized or Evolution-Data ("EVDO"); or successors thereto or hybrids or combinations thereof; or on a wireless local area network ("WLAN") infrastructures such as, by way of non-limiting examples, the Institute for Electrical and Electronic Engineers ("IEEE") 802.11 Standard (and its variants) or Bluetooth™ or the like or hybrids or combinations thereof. Note that in an example variation of system **50** it is contemplated that link **70** may be a wired connection.

Servers **58** can be based on any well-known server environment including a module that houses one or more central processing units, volatile memory (e.g. random access memory), persistent memory (e.g. hard disk devices) and network interfaces to allow servers **58** to communicate over network **74**. For example, each server **58** can be a ProLiant® Server from Hewlett-Packard Company, 3000 Hanover Street Palo Alto, Calif. 94304-1185 USA having a plurality of central processing units and having several gigabytes of random access memory. However, it is to be emphasized that this particular server is merely a non-limiting example, and a vast array of other types of computing environments for each server **58** is contemplated. Furthermore, it is contemplated that each server **58** may be implemented as a plurality of interconnected servers, in a so-called server farm, which are mirrored or otherwise configured for load balancing or failover or high availability or any or all of those.

As will be discussed further below, each server **58** maintains a different server-side networking application **60**. Networking applications **60** can be any application whereby a corresponding client-side application executes on mobile computing device **54** which accesses data or any other server functions on a given server **58**. Networking applications can be, by way of non-limiting examples, web pages, personal information management applications, social networking applications, or messaging applications. Non-limiting examples of personal information management applications include calendaring and contact management applications. Non-limiting examples of social networking application **60** include Facebook™, Twitter™, Linkedln™, and MySpace™. Networking applications **60** can also comprise message applications such as email, BlackBerry Messenger, AOL instant messenger (AIM), Yahoo Messenger (YM), Google Talk (Gtalk), Lotus Connections, Windows Live Messenger. There are many others.

FIG. **2** and FIG. **3** show different views and representations of a non-limiting example of a mobile computing device **54** which can execute one or more applications as discussed in greater detail below. It is to be understood that mobile computing device **54** is an example, and it will be apparent to those skilled in the art that a variety of different portable electronic device structures are contemplated. Indeed variations on mobile computing device **54** can include, without limitation, a cellular telephone, a portable email paging device, a network enabled digital camera, a portable music player, a portable video player, a portable video game player, a tablet computer.

Referring to FIG. **2**, in a present, non-limiting example, device **54** comprises a chassis **154** that supports a display **158**. Display **158** can comprise one or more light emitters such as an array of light emitting diodes (LED), liquid crystals, plasma cells, or organic light emitting diodes (OLED). Other types of light emitters are contemplated. Chassis **154** also support a keyboard **162**. It is to be understood that this specification is not limited to any particular structure, spacing, pitch or shape of keyboard **162**, and the depiction in FIG. **2** is an example. For example, full or reduced "QWERTY" keyboards are contemplated. Other types of keyboards are contemplated. (In variations, device **54** may also be a touchscreen device with no physical keyboard, a non-limiting example of which is discussed below.) Device **54** also comprises a pointing device **164** which can be implemented as a touch-pad, joystick, trackball, track-wheel, or as a touch sensitive membrane on display **158**. Device **54** may also comprise a speaker **166** for generating audio output, and a microphone **168** for receiving audio input.

FIG. **3** shows a schematic block diagram of the electronic components of device **54**. It should be emphasized that the structure in FIG. **3** is an example. Device **54** includes a plurality of input apparatus which in a present embodiment includes keyboard **162**, pointing device **164**, and microphone **168** and an optical capture unit **176**. Fewer, additional, or alternative input apparatuses are contemplated. Input from keyboard **162**, pointing device **164** and microphone **168** and optical capture unit **176** is received at a processor **100**. (Note a plurality of processors may be used in device **54**). Processor **100** can be configured to execute different programming instructions that can be responsive to the input received via input apparatuses. To fulfill its programming functions, processor **100** is also configured to communicate with a non-volatile storage unit **104** (e.g. Erase Electronic Programmable Read Only Memory ("EEPROM"), Flash Memory) and a volatile storage unit **108** (e.g. random access memory ("RAM")). Programming instructions that implement the functional teachings of device **54** as described herein are typically maintained, persistently, in non-volatile storage unit **104** and used by processor **100** which makes appropriate utilization of volatile storage **108** during the execution of such programming instructions.

Processor **100** in turn is also configured to control display **158**, a backlight **160** for illuminating display **158**, speaker **166** and flash **172**, also in accordance with different programming instructions and optionally responsive to different input receive from the input apparatuses. Fewer, additional, or alternative output apparatuses are contemplated. Note that backlight **160** may also be configured to illuminate keyboard **162** or other portions of device **50** other than, or in addition to, display **158**. The teachings in relation to deactivating backlight **160** and reactivating backlight **160** are likewise applicable to such other uses of backlight **160**.

Processor **100** also connects to a network interface **112**, which can be implemented in a present embodiment as one or more radios configured to communicate over link **70**. Network interface **112** can thus be generalized as a further input/output apparatus that can be utilized by processor **100** to fulfill various programming instructions. It will be understood that interface **112** is configured to correspond with the network architecture that defines link **70**. It is also contemplated each network interface **112** can include multiple radios to accommodate the different protocols that may be used to implement different types of links where the network architecture for each link **70** differs between base stations **66**.

A power supply **114**, typically in the form of a rechargeable battery, is also provided. While FIG. **3** shows power supply **114** connected to processor **100**, it will be understood that processor **100** generally provides electrical power to all power-consuming components in device **54**.

In a present embodiment, device **54** is also configured to maintain, within non-volatile storage **104**, a web browser application **124**. One or more of a plurality of additional client networking applications **128** may also be provided. Non-limiting examples of additional applications **128** can comprise, without limitation, one or more of social networking client applications, e.g., Twitter, Facebook, MySpace, LinkedIn; other applications associated with online communities e.g., Flickr, Gtalk, etc; document tools such as Google Docs. Any one or more of browser application **124** and client applications **128** can be pre-stored in non-volatile storage **104** upon manufacture of device **54**, or downloaded via network interface **112** and saved on non-volatile storage **104** at any time subsequent to manufacture of device **54**. Each application **124**, **128** is configured to interact with a corresponding network application **60** as needed.

Processor **100** is configured to execute each application **124**, **128**, making use of input from apparatuses and controlling display **158** to generate output based on that input and according to the programming instructions of each application **124**, **128**. Backlight **160** is selectively activated in accordance with the teachings herein in order to manage power drain from power supply **114**. In general, each application **124**, **128** can be based on any existing or future application **124**, **128** that can be executed entirely on a device such as device **54**.

Processor **100** is also configured to execute web browser application **124** to permit access to networking applications **60** via network **74**, as will be explained further below.

Referring briefly to FIG. **4**, a variation on device **54** is indicated generally as device **54***a*. Device **54***a* comprises many of the same components as device **54**, and therefore like components bear like references except followed by the suffix "a". Of note is that device **54***a* excludes a physical keyboard **162** and pointing device **164**. Instead, device **54***a* comprises a touch screen **164***a* which provides the combined functionality of keyboard **162** and pointing device **164**. Further variations on device **54** will now occur to those skilled in the art, but for convenience, further discussion of the present specification will focus on device **54** as described above.

Referring now to FIG. **5**, a flow-chart depicting a method for power management in a mobile computing device is indicated generally at **500**. Method **500** can be implemented using system **50**, and for purposes of explaining method **500** it will be assumed that method **500** is performed using system **50**. However, it is to be understood that variations are contemplated to both method **500** and system **50** and such variations are within the scope of this specification.

Block **505** comprises activating a device backlight, and block **510** comprises controlling the device display according to a selected device interaction. There are virtually limitless ways that block **505** and block **510** can be implemented, and in general block **505** and block **510** reflect an activation of display **158** and backlight **160** under the control of processor **100** to generate images that correspond to an application that is currently being executed by processor **100**. For example, a main menu application (not shown in FIG. **3**) may be active whereby various options for executing browser application **124** or one of the additional applications **128** are offered, and whereby input received by keyboard **162** or pointing device **164** may be received at processor **100** to invoke an application corresponding to the selected option.

Block **515** comprises determining if a networking application is selected. A "no" determination from block **515** leads back to block **510**, whereas a "yes" determination leads to block **520**. The means by which block **515** are effected are not particularly limited. In general, if an application that makes use of a network application **60** via network **74** is selected, then a "yes" determination is reached, whereas otherwise a "no" determination is reached at block **515**. In the specific but non-limiting example of device **54**, if processor **100** is instructed to execute application **124** or an additional application **128** then a "yes" determination is made at block **515**, and otherwise a "no" determination is reached.

Assuming a "yes" determination is made at block **515**, then block **520** comprises activating the application selected at block **520**. The term "activating" is not to be construed in a limiting sense and generally refers to the execution of such an application on processor **100**.

FIG. **6** shows exemplary execution by processor **100** of browser application **124** where, as a result of such execution, processor **100** controls display **158** to generate a plurality of graphic elements. FIG. **7** shows the same view as FIG. **6**, but also includes references identifying the various graphic elements, which comprise, in a non-limiting example, a status bar **250**, an address bar **254**, a browser pane **258**, and a tool bar **262**.

Status bar **250** comprises a favicon **266** (which is a short form for "favorites icon") and a page title **270** which identifies a title for the contents shown in browser pane **258**. Favicon **266** is a graphic that can represent the page title **270**. Note that the appearance of favicon **266** and page title **270** varies according to the contents of browser pane **258**.

Status bar **250** also comprises a message indicator **274** that indicates a number of waiting or unopened messages that are associated with a message application (e.g. one of the additional applications **128**) that is also executable by processor **100**. In the present example, four messages are shown as waiting or unopened. Status bar **250** also comprises a network type indicator **278**, indicating the protocol that is currently active over network interface **112**. In this example, a 3G network is active. Status bar **250** also comprises a network strength indicator **282**, indicating the signal strength of the currently active network **282** identified by indicator **278**. Note that the appearances of message indicator **274**, network type

indicator **278** and network strength indicator **282** are independent of the contents of browser pane **258**.

Those skilled in the art will now appreciate that status bar **250** can comprise fewer or additional elements indicating the overall status of device **50**, including, by way of non-limiting example, time, date and battery strength.

Address bar **254** comprises an active-page indicator **286** and an address field **290**. Active-page indicator **286** reflects the functionality of browser application **124** whereby browser application **124** can simultaneously access a plurality of different web pages via network interface **112**. In FIG. **6** and FIG. **7**, active-page indicator **286** shows the numeral "**1**", indicating an identifier of the web page is currently being accessed. Address field **290** contains the Uniform Resource Locator (URL) that corresponds to the contents shown in browser pane **258** as well as favicon **266** and page title **270**.

Browser pane **258** shows the web page contents corresponding to the web page that is hosted at the URL within address field **290**.

Tool bar **262** comprises a plurality of icons representing different tools which can be selected via pointing device **164**. In a present non-limiting example, tool bar **262** comprises a URL soft-button **294** which can be activated to send a signal to processor **100** so as to cause processor **100** to receive input of another URL for another web page to be generated on display **158** in browser pane **258**. Tool bar **262** also comprises a bookmark soft-button **298** which can be activated to send a signal to processor **100** so as to cause processor **100** to add the current page shown in browser pane **258** as a bookmark or for other bookmark operations. Tool bar **262** also comprises a select soft-button **302** which can be activated to send a signal to processor **100** so as to cause processor **100** to receive input of a portion of browser pane **258** to select portions of text or images within browser pane **258**. Tool bar **262** also comprises a zoom-in soft-button **306** and a zoom-out soft-button **310**, either of which can be activated to send a signal to processor **100** so as to cause processor **100** to either zoom-in to, or zoom-out from, a particular region or other area of interest within browser pane **258**.

At this point it is to be reiterated that the various elements shown in FIG. **6** and FIG. **7** are exemplary features of browser application **124** and that variations thereon are contemplated.

The views in FIG. **6** and FIG. **7** provide a non-limiting example of performance of block **520**, where the selected networking application is browser application **124** and the contents in browser pane **258** are provided from a server **58** addressable via the URL in address field **290**. Further, also of note is that the contents in browser pane **258** comprise a link **314** to a video that can be played on device **54** through a video player application embedded within browser **124**. Alternatively device **54** can be configured so that the video is playable in a separate video player application that is one of the additional applications **128** that can be invoked via link **314** from browser **124**.

The selection of link **314** comprises one way in which method **500** can be advanced from block **520** to block **525**. Block **525** thus comprises accessing a network server. In general terms, block **525** contemplates the connection of the device **54** to a remote computer such as one of the servers **58**. In the example in relation to FIG. **7**, the selection of link **314** results in an instruction to processor **100** requesting the download of the file associated with link **314** to device **54**. Assuming link **314** is selected, then the view in FIG. **8** can be generated which shows a download progress bar **318** as having advanced slightly past zero percent reflecting the download of content **60** from server **58**.

Block **530** comprises determining if a network download is in progress. In general terms block **530** comprises a determination if a data transfer is occurring between device **54** and one of the servers **58**. If a "no" determination is made then method **500** advances to block **535**, which will be discussed further below. Given the hypothetical example in FIG. **8**, a "yes" determination is made at block **530** thereby advancing to block **540**.

Block **540** comprises deactivating the backlight in order to reduce power consumption. Exemplary performance of block **540** is shown in FIG. **9** and FIG. **10**. In FIG. **9**, an advisory message is shown indicating that the display will be turned off until the download is complete. Optionally, during display of the view in FIG. **9**, display **158** can be partially powered, in a dimmed state, for a short time duration rather than being fully powered into a fully bright state. In FIG. **10**, the circuit between backlight **160** and display **158** is shown in an open position, such that display **158** is black due to the fact that backlight **160** is unpowered.

Block **545** comprises determining if the download contemplated at block **530** is complete, or at least a certain portion of the download is complete. A "no" determination leads to block **535**, whereas a "yes" determination leads to block **505**, whereupon the backlight is reactivated. A "no" determination when content **60** has not completed a full transfer from server **58** to device **54**, such that progress bar **318** would (if it were visible) indicates less than one-hundred percent. In contrast, a "yes" determination would be reached when content **60** has completed a fully transfer from server **58** to device **54**, such that progress bar **318** would (if it were visible) indicate one-hundred percent. (Alternatively, a yes determination could also be reached in the event that a non-recoverable failure of the download had occurred such that the download cannot complete. Such a failure could occur due to any number of circumstances, such as a communication error over link **74**, or an overload of server **58**. This alternative is shown in FIG. **13** as method **500***a*, which is the same as method **500** except that block **541***a* is also provided whereby a determination is made as to whether an error has occurred during the download.)

Block **535** comprises determining if any device interaction has occurred. A "yes" determination leads to block **505** at which point backlight **505** is reactivated so that the contents of display **158** becomes visible again, while a "no" determination leads back to block **530**. What constitutes device interaction, and thereby results in a "yes" determination is not particularly limited, but in the context of device **54**, device interaction may include the receipt of any input from keyboard **162** or pointing device **164** or any other selected input apparatus on that is present on device **54**. Device interaction can also include, however, an event or notification generated by an application executing on device **54** for which activation of display **154** is important. Where conditions do not result in a "yes" determination then a "no" determination is reached.

When conditions result in a loop from block **530** to block **540** to block **545**, to block **535** and back to block **530** occurs, then display **158** maintains the appearance shown in FIG. **10**. Conditions resulting in this kind of loop occur when the download is in progress but no device interaction is occurring.

When a download is not complete while at block **545**, method **500** will advance from block **545** to block **535**. However if a device interaction has occurred that results in a "yes" determination at block **535**, then method **500** will advance to block **505**. An example of these conditions is shown in FIG. **11**, whereby the depression of a single key on keyboard **162** has been received resulting in a "yes" determination at block **535** and leading to block **505** thereby causing reactivation of backlight **160**. During such reactivation, the current level of

download progress is shown, as well as a message indicating that the display will turn off again until the download is complete. If no other device interactions occur, then method **500** will cycle eventually back to block **540** so that backlight **160** is again deactivated leading device **54** back to the state shown in FIG. **10**.

When a download is determined to complete at block **545**, method **500** advances from block **545** to block **505**, at which point the backlight is reactivated. FIG. **12** shows an example of device **54** in this state, whereby backlight **160** has been reactivated and thus display **158** is lit. Progress bar **318** indicates that the download is complete and prompts for further input.

Variations, subsets, enhancements and combinations of the foregoing are contemplated. For example, while backlight **160** and display **158** are contemplated, it will be understood that in other types of display technologies, a backlight may be obviated such that it is the display itself that is turned off at block **545** and turned on at block **505**. Furthermore, it will be understood that the types of device interaction that can lead to a "yes" determination at block **535** are not particularly limited, and can include the possibility that processor **100** is configured to execute multiple applications, so that blacklight **160** may be reactivated so that the graphic interfaces of another application may be generated on display **154** (with backlight **160** therefore active) while the download is occurring. As another non-limiting example, while backlight **160** is off, device **54** can be configured so that an incoming telephone call is sufficient to result in a "yes" determination at block **535**. Other examples of events that can result in a "yes" determination at block **535** comprise, without limitation, when an automatic refresh of web page occurs, when any type of data other than the download data is pushed to device **54**, an alarm, calendar notification, when a data input request from another application is generated on display **158**, or when a secure web page (e.g. a bank web site) generates a warning of automatic connection termination due to inactivity.

As another variation, method **500** can be modified so that when a download is complete, rather than reactivating backlight **160**, another type of output can be generated. For example, where device **54** is equipped with a light emitting diode (LED) or other light-emitting indicator, then method **500** can be modified so that when the download is complete, the LED indicator flashes, but the backlight **160** itself remains off until input is detected via keyboard **162** or pointing device **164** or other input apparatus. This variation can be extended beyond LED indicators, to include haptic output, or an audible alarm generated via speaker **166**.

As another variation, device **54** can be configured so that the transition between the view in FIG. **9** and FIG. **10** is accomplished via a fading-out effect or dimming. Indeed, it should be understood that in general the term "deactivate" should be construed in a non-limiting sense and can include various methodologies whereby the result is that display **158** or backlight **160** or both of them draw a reduced amount of power from power supply **114** than when display **158** or backlight **160** or both of them are active. Likewise, the term "activate" can also be accomplished through various methodologies to bring display **158** or backlight **160** into an active state whereby additional power is drawn from power supply **114** in order that display **158** is controlled to emit images therefrom.

As a still further variation, content **60** itself can be configured to include a flag to signal to device **54** to reactivate backlight **160**. Such a flag may be included at the very end of the content **60** so that the backlight is activated when the download of content **60** is complete, or somewhat before the download is complete so there is a warning or indication that the download is nearly complete. Likewise, method **500** can be modified so that block **545** results in a "yes" determination when the download is nearly complete. The term "nearly complete" contemplates that at a predetermined point in the download prior to a complete download, a "yes" determination would be reached. Such a predetermined point could be, for example, when the download is ninety-five percent complete, or when an estimated remaining amount of time is below a certain threshold.

It should also be understood that method **500** can be applied to the download (or, in a more generic sense, a data transfer) of any type of content, including web pages, data files, videos, music, scripts, maps, or applications. In the case of applications for which a download and installation has been instructed, then device **50** can be configured to only reactivate the backlight after both the download and the installation has been effected.

Method **500** can also be integrated into traditional screen-saver or backlight timers programs which are currently deployed to deactivate a backlight or display itself (or to activate a screen-saver graphic) when a predetermined time period of inactivity has elapsed. In this variation, the timer countdown can be advanced to the threshold time for deactivating the display immediately upon, or within a predetermined time period after, a download has been commenced. By the same token, the traditional screen-saver or backlight timer programs can be modified to reset the countdown timer immediately upon completion of the download so that the backlight or display is automatically reactivated but the countdown timer recommences so that the backlight or display will be deactivated when a further download commences or when a period of inactivity has elapsed.

As another variation, method **500** can be modified for file uploads in addition to file downloads, or bi-directional transfers. In general method **500** is applicable to any type of data transfer between device **54** and a remote computer, whether through a network or even via a peer-to-peer connection, such as through a Bluetooth™ connection.

As another variation, method **500** can be modified for file transfers within different storage devices in, or directly connected to, device **54**. For example, method **500** can be applied to a transfer between non-volatile storage **104** and a removable storage device (not shown) that connects to device **54**.

In general terms, it will now be understood that method **500** can be applied to any type of remote computing apparatus that is connectable to device **54**, including a server, a peer-to-peer connected computing device, or even a removable storage device associated with device **54**.

In addition to file transfers, various other types of device processing can be applied to variations of method **500**. For example, if device is in any state where regular processing is occurring and does not require user interaction. For example, when installing an application or moving files between internal memory and removable storage device. As another example, where device **54** is equipped with an audio player, then when device **54** is playing the audio file, the display (or backlight) could be deactivated or dimmed, and then reactivated upon termination of the play back. As another example, where device **50** is booting up, loading a large file from non-volatile storage into processor **100**, or when applying a graphical theme. In general, method **500** can be applied to any process that takes some time for completion during which input is optional and usually intended to switch tasks or to escape the current action. A non-limiting example of this variation is shown in FIG. **14** as method **500***b*. Method **500***b* is a variation of method **500** and thus like blocks bear like

references except followed by the suffix "b". Of note is that block **515***b* comprises determining that a processing operation is occurring which does not require user interaction, such as generation of output or reception of input. On a yes determination at block **515***b*, method **500***b* advances to block **540***b* and the backlight is deactivated. Block **545***b* is a variation on block **545**, and comprises determining if at least a portion of the operation contemplated at block **515***b* is complete. Block **535***b* is substantially the same as block **535**, and contemplates a determination whereby, notwithstanding the fact that the processing operation contemplated at block **515***b* does not require interaction, nonetheless some sort of device interaction is occurring. Thus, those skilled in the art will now recognize that the processing operation contemplated at block **515***b* can comprise, as indicated above, and by way of non-limiting examples, a download, a file transfer, an application installation, playing an audio file, device boot-up, installation of a device theme.

As another variation, the advisory message in FIG. **9** can be made more express, such as by stating: "The display will be powered down to reduce power consumption and conserve battery and will be restored upon completion of the requested operation, please wait or press any key to abort".

As noted earlier, all of the foregoing can be incorporated into, or associated with a traditional screen-saver or backlight timer application.

Other variations, combinations, and subsets will now occur to those skilled in the art. Furthermore, various advantages will now be apparent, including the fact that a reduced level of power is drawn from power supply **114** when backlight **160** is off, and thereby increasing the amount of time needed between charges to power supply **114**.

The invention claimed is:

1. A method for power management in a mobile computing device comprising:

activating a display in said mobile computing device such that a first amount of power is drawn from a power supply of said mobile computing device;

maintaining a timer for measuring periods of inactivity at said mobile computing device; said timer configured to deactivate said display when said timer reaches a predefined threshold;

initiating a data transfer operation to retrieve content for presentation on said display;

in response to said initiating, advancing said timer to said predefined threshold by setting said timer to a value greater than a current period of inactivity, to deactivate said display such that a second amount of power is drawn from said power supply, said second amount being less than said first amount;

during retrieval of said content, detecting a flag in said content indicating that a predefined portion of said content has been downloaded, said flag at a location in said content that indicates the predefined portion being downloaded, the flag comprising a warning that download of said content is complete or nearly complete;

in response to said detecting, automatically reactivating said display; and

automatically activating at least one of a light emitting diode indicator, a speaker, or a haptic output device in response to said detecting;

wherein: said data transfer operation is for retrieving said content from a remote computing apparatus connected to said mobile computing device; said remote computing apparatus is at least one of a server connected to said computing device via a network and said data transfer operation is a download from said server; another computing device connected via a peer-to-peer connection to said computing device; a storage device locally connectable to said computing device; said display comprises a backlight and said activating comprising activating said backlight and said deactivating comprises deactivating said backlight; and said data transfer operation comprises at least one of a file transfer, an application installation, playing an audio file, implementing a device boot-up sequence, and installation of a device theme.

2. The method of claim **1** wherein said deactivating comprises one of dimming said display and turning off said display such that said second amount is zero.

3. The method of claim **1**, further comprising reactivating said display during said data transfer operation upon detecting a device interaction other than the detection of said flag.

4. The method of claim **3** further comprising deactivating said display if said device interaction ceases and said flag has not been detected.

5. The method of claim **3** wherein said device interaction comprises one of receipt of input via an input apparatus connected to said mobile computing device; when an automatic refresh of web page occurs; when any additional content other than said content is received by said device; an alarm; a calendar notification; when a secure web page generates a warning of automatic connection termination due to inactivity.

6. The method of claim **1** further comprising reactivating said display if said data transfer operation fails before said flag has been detected.

7. A mobile computing device comprising:

a power supply;

a display connected to said power supply;

a processor connected to said power supply and said display; said processor configured to:

activate said display such that a first amount of power is drawn from said power supply of said mobile computing device;

maintain a timer for measuring periods of inactivity at said mobile computing device; said timer for deactivating said display when said timer reaches a predefined threshold;

initiate a data transfer operation to retrieve data for presentation on said display;

in response to said initiating, advance said timer to said predefined threshold by setting said timer to a value greater than a current period of inactivity, to deactivate said display such that a second amount of power is drawn from said power supply, said second amount being less than said first amount;

during retrieval of said content, detect a flag in said content indicating that a predefined portion of said content has been downloaded, said flag at a location in said content that indicates the predefined portion being downloaded, the flag comprising a warning that download of said content is complete or nearly complete;

in response to said detecting, automatically reactivate said display; and

automatically activate at least one of a light emitting diode indicator, a speaker, or a haptic output device in response to said detecting;

wherein: said data transfer operation is for retrieving said content from a remote computing apparatus connected to said mobile computing device; said remote computing apparatus is at least one of a server connected to said computing device via a network and said data transfer operation is a download from said

server; another computing device connected via a peer-to-peer connection to said computing device; a storage device locally connectable to said computing device; said display comprises a backlight and said activating comprising activating said backlight and said deactivating comprises deactivating said backlight; and said data transfer operation comprises at least one of a file transfer, an application installation, playing an audio file, implementing a device boot-up sequence, and installation of a device theme.

8. The mobile computing device claim **7** wherein said deactivating comprises dimming said display or turning off said display such that said second amount is zero.

9. The mobile computing device claim **7** wherein said processor is further configured to reactivate said display during said data transfer operation upon detecting a device interaction other than the detection of said flag.

10. The mobile computing device of claim **9** wherein said processor is further configured to deactivate said display if said device interaction ceases and said flag has not been detected.

11. The mobile computing device of claim **9** wherein said device interaction comprises one of receipt of input via an input apparatus connected to said mobile computing device; when an automatic refresh of web page occurs; when any additional content other than said content is received by said device; an alarm; a calendar notification; when a secure web page generates a warning of automatic connection termination due to inactivity.

12. The mobile computing device of claim **7** wherein said processor is further configured to reactivate said display if said data transfer operation fails before said flag has been detected.

13. A non-transitory computer readable medium storing a computer program, wherein execution of the computer program is for:

activating a display in said mobile computing device such that a first amount of power is drawn from a power supply of said mobile computing device;

maintaining a timer for measuring periods of inactivity at said mobile computing device; said timer configured to deactivate said display when said timer reaches a predefined threshold;

initiating a data transfer operation to retrieve data for presentation on said display;

in response to said initiating, advancing said timer to said predefined threshold by setting said timer to a value greater than a current period of inactivity, to deactivate said display such that a second amount of power is drawn from said power supply; said second amount being less than said first amount;

during retrieval of said content, detecting a flag in said content indicating that a predefined portion of said content has been downloaded, said flag at a location in said content that indicates the predefined portion being downloaded, the flag comprising a warning that download of said content is complete or nearly complete;

in response to said detecting, automatically reactivating said display; and

automatically activating at least one of a light emitting diode indicator, a speaker, or a haptic output device in response to said detecting;

wherein: said data transfer operation is for retrieving said content from a remote computing apparatus connected to said mobile computing device; said remote computing apparatus is at least one of a server connected to said computing device via a network and said data transfer operation is a download from said server; another computing device connected via a peer-to-peer connection to said computing device; a storage device locally connectable to said computing device; said display comprises a backlight and said activating comprising activating said backlight and said deactivating comprises deactivating said backlight; and said data transfer operation comprises at least one of a file transfer, an application installation, playing an audio file, implementing a device boot-up sequence, and installation of a device theme.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,250,691 B2
APPLICATION NO. : 12/964335
DATED : February 2, 2016
INVENTOR(S) : Casey Vandeputte and Teodoro Salluzzi

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 13, Line 11, In Claim 8, after "device" insert -- of --.

Column 13, Line 14, In Claim 9, after "device" insert -- of --.

Signed and Sealed this
Fifteenth Day of November, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office